

WE CLAIM:

1. An isolated nucleic acid that encodes a plant fatty acid epoxygenase polypeptide.
2. The isolated nucleic acid according to claim 1 wherein the epoxygenase is a mixed-function monooxygenase that catalyzes the epoxygenation of a carbon bond in a fatty acid molecule.
3. The isolated nucleic acid according to claim 2, wherein the carbon bond is a double bond in an unsaturated fatty acid molecule.
4. The isolated nucleic acid according to claim 1 wherein the epoxygenase is a Δ 12-epoxygenase.
5. The isolated nucleic acid according to claim 1 wherein the plant is *Crepis spp.* or *Vernonia spp.*
6. The isolated nucleic acid according to claim 5 wherein the plant is *Crepis palaestina*.
7. The isolated nucleic acid according to claim 5 wherein the plant is *Vernonia galamensis*.
8. An isolated nucleic acid encoding a plant fatty acid epoxygenase polypeptide comprising a nucleotide sequence selected from the group consisting of:
 - (i) a sequence having at least about 65% identity to a sequence selected from the group consisting of SEQ ID No: 1, SEQ ID NO: 3, SEQ ID NO: 5 and SEQ ID NO: 19 as determined using the default parameters of the Sequence and Analysis Software Package of the Computer Genetic Group (GCG) at the University of Wisconsin;
 - (ii) a sequence encoding an amino acid sequence that is at least about 65% identical to a sequence selected from the group consisting of SEQ ID No: 2, SEQ ID NO: 4, SEQ ID NO: 6 and SEQ ID NO: 20 as determined using the default parameters of the Sequence and Analysis Software Package of the GCG at the University of Wisconsin; and

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(iii) a sequence that is complementary to (i) or (ii).

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9. The isolated nucleic acid according to claim 8 comprising a nucleotide sequence that is at least about 65% identical a sequence selected from the group consisting of SEQ ID No: 1, SEQ ID NO: 3, SEQ ID NO: 5 and SEQ ID NO: 19.
10. An isolated nucleic acid from the plant *Vernonia* that encodes a fatty acid epoxygenase polypeptide wherein said nucleic acid comprises a nucleotide sequence selected from the group consisting of:
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- (i) the sequence set forth in SEQ ID NO: 19;
- (ii) a sequence encoding the amino acid sequence set forth in SEQ ID NO: 20; and
- (iii) a sequence that is complementary to (i) or (ii).
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11. An isolated nucleic acid comprising the nucleotide sequence set forth in SEQ ID NO: 19 or a complementary nucleotide sequence thereto.
12. The isolated nucleic acid according to claim 1 wherein said nucleic acid comprises a nucleotide sequence that hybridizes under at least low stringency conditions to at least 20 contiguous nucleotides complementary to a sequence selected from the group consisting of SEQ ID No: 1, SEQ ID NO: 3, SEQ ID NO: 5 and SEQ ID NO: 19.
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13. A gene construct that comprises the isolated nucleic acid according to claim 1 operably connected to a promoter sequence, wherein said nucleic acid is capable of being transcribed in the sense or antisense orientation relative to the direction of *in vivo* transcription of a naturally-occurring epoxygenase gene.
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14. A gene construct that comprises the isolated nucleic acid according to claim 8 operably connected to a promoter sequence, wherein said nucleic acid is capable of being transcribed in the sense or antisense orientation relative to the direction of *in vivo* transcription of a naturally-occurring epoxygenase gene.
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15. A gene construct that comprises the isolated nucleic acid according to claim 10 operably connected to a promoter sequence, wherein said nucleic acid is capable of being transcribed in the sense or antisense orientation relative to the direction of *in vivo* transcription of a naturally-occurring epoxygenase gene.
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16. A method of altering the level of epoxy fatty acids in a plant or a cell, tissue, or organ of said plant, said method comprising introducing a gene construct comprising the isolated nucleic acid of claim 1 to a plant cell, tissue, or organ, regenerating said cell, tissue or organ into a whole plant and growing said plant under conditions sufficient to express said isolated nucleic acid in a cell, tissue or organ of said plant.
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17. The method according to claim 16, wherein the isolated nucleic acid is expressed to produce a functional epoxygenase polypeptide in said cell, tissue, or organ.
18. The method of claim 16 wherein the plant organ is a seed.
19. The method of claim 16 wherein the plant cell, tissue or organ produces high levels of linoleic acid in its seed in its native state.
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20. A method of producing a recombinant enzymatically active epoxygenase polypeptide in a plant cell, said method comprising:
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- (i) producing a gene construct that comprises the isolated nucleic acid of claim 1 operably under the control of a promoter that is operable in said plant cell;
 - (ii) transforming said gene construct into said cell; and
 - (iii) selecting transformants which express a functional epoxygenase encoded by the genetic sequence at a high level.
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21. A plant transformed with the isolated nucleic acid according to claim 1.
22. A progeny of the plant according to claim 21 wherein said progeny also comprises said nucleic acid.

23. The plant of claim 21 selected from the group consisting of: *Arabidopsis thaliana*, Linola™ flax, oilseed rape, sunflower, safflower, soybean, linseed, sesame, cottonseed, peanut, olive and oil palm.
- 5 24. The plant of claim 23 consisting of an *A. thaliana* plant.
25. The plant of claim 23 consisting of a Linola™ flax plant.

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